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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,047	11/18/2003	Tien-Jen Cheng	FIS920030278US1	1046
29371	7590	10/05/2005	EXAMINER	
CANTOR COLBURN LLP 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002			VAN, LUAN V	
			ART UNIT	PAPER NUMBER
			1753	

DATE MAILED: 10/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/707,047

Applicant(s)

CHENG ET AL.

Examiner

Luan V. Van

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) 8-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-14 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 11-18-03.
- 4) ☒ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-7, drawn to a method, classified in class 205, subclass 123.
- II. Claims 8-14, drawn to a product, classified in class 216, subclass 18.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as sputtering deposition or chemical vapor deposition.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper, restriction for examination purposes as indicated is proper.

During a telephone conversation with the Applicant's representative, Sean Sullivan, on 9/22/05 a provisional election was made with traverse to prosecute the

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invention of Group I, claims 1-7. Affirmation of this election must be made by applicant in replying to this Office action. Invention of Group II is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The layer "Cu/CrCu" can be interpreted as Cu and CrCu; Cu or CrCu; or Cu over CrCu. It is believed the applicant intended the layer to be interpreted as Cu over CrCu and, thus, is treated as such.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4 and 6-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Nye et al.

Regarding claims 1 and 6, Nye et al. teach a method for selective electroplating an interconnection pad, the method comprising: forming a titanium-tungsten (TiW) layer (column 6 lines 47-55) over a passivation layer on a semiconductor substrate, said TiW layer further extending into an opening formed in said passivation layer for exposing the interconnection pad, such that said TiW layer covers sidewalls of said opening and a top surface of the pad; forming a seed layer (column 6 lines 47-55) over said TiW layer, selectively removing portions of said seed layer (column 7 lines 35-37) such that remaining seed layer material corresponds to a desired location of interconnect metallurgy for the interconnection pad; and electroplating at least one metal layer over said remaining seed layer material (column 7 lines 55-67), using said TiW layer as a conductive electroplating medium. Further, Nye et al. teach the copper seed layer is patterned by depositing a blanket layer and subtractively etching it using a resist mask (column 7 lines 35-37). The solder is then selectively electroplated on the remaining seed layer in the subsequent step.

Regarding claim 2, Nye et al. teach the seed layer further comprises a Cu/CrCu layer (column 6 lines 47-55).

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Regarding claim 4, Nye et al. teach removing portions of said TiW layer not covered by said at least one metal layer following electroplating thereof (column 8 lines 24-27).

Regarding claim 7, Nye et al. teach the passivation layer further comprises a photosensitive polyimide (PSPI) layer (column 7 lines 7-11).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nye et al. in view of Love et al.

Nye et al. teach the method as described above in addressing claim 1. Nye et al. also teach that nickel can be used in addition to copper (column 10 lines 15-18) for bonding the CrCu layer and the gold layer (column 4 lines 35-38). The difference between the reference to Nye et al. and the instant claims is that the reference does not explicitly teach electroplating a nickel or the gold layer.

It is well known in the art that nickel and gold can be electroplated, and that the nickel and gold layer are deposited between the copper and the solder material. Love et al., for example, teach that the nickel layer acts as a barrier to any solder-copper chemical interactions (column 9 lines 33-25), and that gold is plated on the nickel layer to protect it from environmental corrosion and attack, since the nickel layer is susceptible to oxidation (column 24 lines 66-column 25 line 2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Nye et al. by electroplating the nickel layer followed by the gold layer as taught by Love et al., because plating the nickel layer prevents any solder-copper chemical interactions and plating the gold layer on the nickel layer protects it from environmental corrosion and attack.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nye et al. in view of Srivastava et al.

Nye et al. teach the method as described above in addressing claim 1. Nye et al. also teach using an electrically conductive layer 60 (figure 3) to form the interconnection pad. The difference between the reference to Nye et al. and the instant claims is that the reference does not explicitly teach the interconnection pad comprises of aluminum.

Srivastava et al. teach that the interconnection pad can be composed of copper or aluminum metal pad or line (column 2 lines 36-39).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Nye et al. by using the aluminum pad of Srivastava et al., because aluminum is a good electrical conductor and is well suited for forming the interconnection pad.

Claims 1-2 and 4-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Srivastava et al. in view of Nye et al.

Regarding claims 1 and 6, Srivastava et al. teach a method for selective electroplating an interconnection pad, the method comprising: forming a titanium-tungsten (TiW) layer (column 2 lines 40-59) over a passivation layer on a semiconductor substrate, said TiW layer further extending into an opening formed in said passivation layer for exposing the interconnection pad, such that said TiW layer

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covers sidewalls of said opening and a top surface of the pad; forming a seed layer (column 2 lines 40-59) over said TiW layer, selectively removing portions of said seed layer (column 2 lines 60-62) such that remaining seed layer material corresponds to a desired location of interconnect metallurgy for the interconnection pad; and electroplating at least one metal layer over said seed layer material (column 2 lines 40-59), using said TiW layer as a conductive electroplating medium.

The difference between the reference to Srivastava et al. and the instant claims is that the reference does not explicitly teach removing portions of the seed layer prior to electroplating on the remaining portions.

Nye et al. teach a method for selective electroplating an interconnection pad, the method comprising: forming a titanium-tungsten (TiW) layer (column 6 lines 47-55) over a passivation layer on a semiconductor substrate, said TiW layer further extending into an opening formed in said passivation layer for exposing the interconnection pad, such that said TiW layer covers sidewalls of said opening and a top surface of the pad; forming a seed layer (column 6 lines 47-55) over said TiW layer, selectively removing portions of said seed layer (column 7 lines 35-37) such that remaining seed layer material corresponds to a desired location of interconnect metallurgy for the interconnection pad; and electroplating at least one metal layer over said remaining seed layer material (column 7 lines 55-67), using said TiW layer as a conductive electroplating medium. Further, Nye et al. teach the copper seed layer is patterned by

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depositing a blanket layer and subtractively etching it using a resist mask (column 7 lines 35-37). The solder is then selectively electroplated on the remaining seed layer in the subsequent step.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Srivastava et al. by removing portions of the seed layer prior to electroplating on the remaining portions as taught by Nye et al., because patterning a seed layer by depositing a blanket layer and subtractively etching it using a resist mask would be a routine undertaking well within the ability of one skilled in the art. Since the chrome and copper layer can be selectively etched over TiW in a potassium sulfate solution and a metal layer would preferentially plate only on the seed layer, it would have been obvious to one having ordinary skill in the art to modify the sequence of steps of Srivastava et al. by patterning the seed layer prior to electroplating.

Regarding claim 2, Srivastava et al. teach the seed layer further comprises a Cu/CrCu layer (column 6 lines 47-55).

Regarding claim 4, Srivastava et al. teach removing portions of said TiW layer not covered by said at least one metal layer following electroplating thereof (column 2 lines 60-67).

Regarding claim 5, Srivastava et al. teach that the interconnection pad can be composed of copper or aluminum metal pad or line (column 2 lines 36-39).

Regarding claim 7, Srivastava et al. teach the passivation layer further comprises a photosensitive polyimide (PSPI) layer (column 6 lines 9-12).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Srivastava et al. in view of Love et al.

Srivastava et al. teach the method as described above in addressing claim 1. The difference between the reference to Srivastava et al. and the instant claims is that the reference does not explicitly teach electroplating a nickel followed by a gold layer.

Love et al. teach forming an interconnect structure comprising plating a nickel layer followed by a gold layer on a copper layer. Further, Love et al. teach that the nickel layer acts as a barrier to any solder-copper chemical interactions (column 9 lines 33-25), and that gold is plated on the nickel layer to protect it from environmental corrosion and attack, since the nickel layer is susceptible to oxidation (column 24 lines 66-column 25 line 2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Srivastava et al. by electroplating the

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nickel layer followed by the gold layer as taught by Love et al., because plating the nickel layer prevents any solder-copper chemical interactions and plating the gold layer on the nickel layer protects it from environmental corrosion and attack.

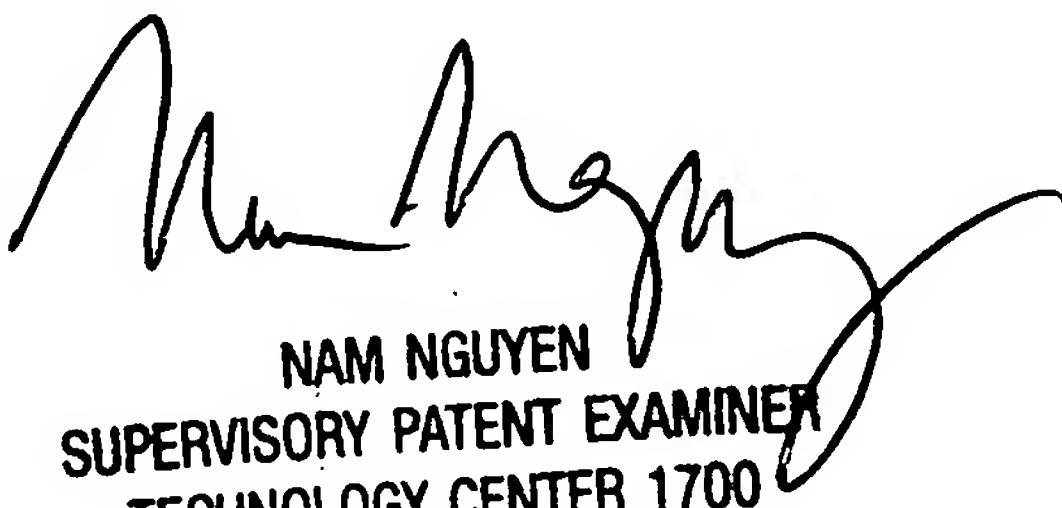
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LWV
9/29/05


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